

# *High Energy Theory*

*BNL*

*April 22, 2003*

*W. Kilgore*

# *Group Members*

## Senior staff

Creutz, Dawson, Marciano, Paige, Pisarski, Soni, Trueman

## Associate physicist

Kilgore

## Post-docs

Berruto, Chen, Izubuchi (left 2/1/03), Kulesza

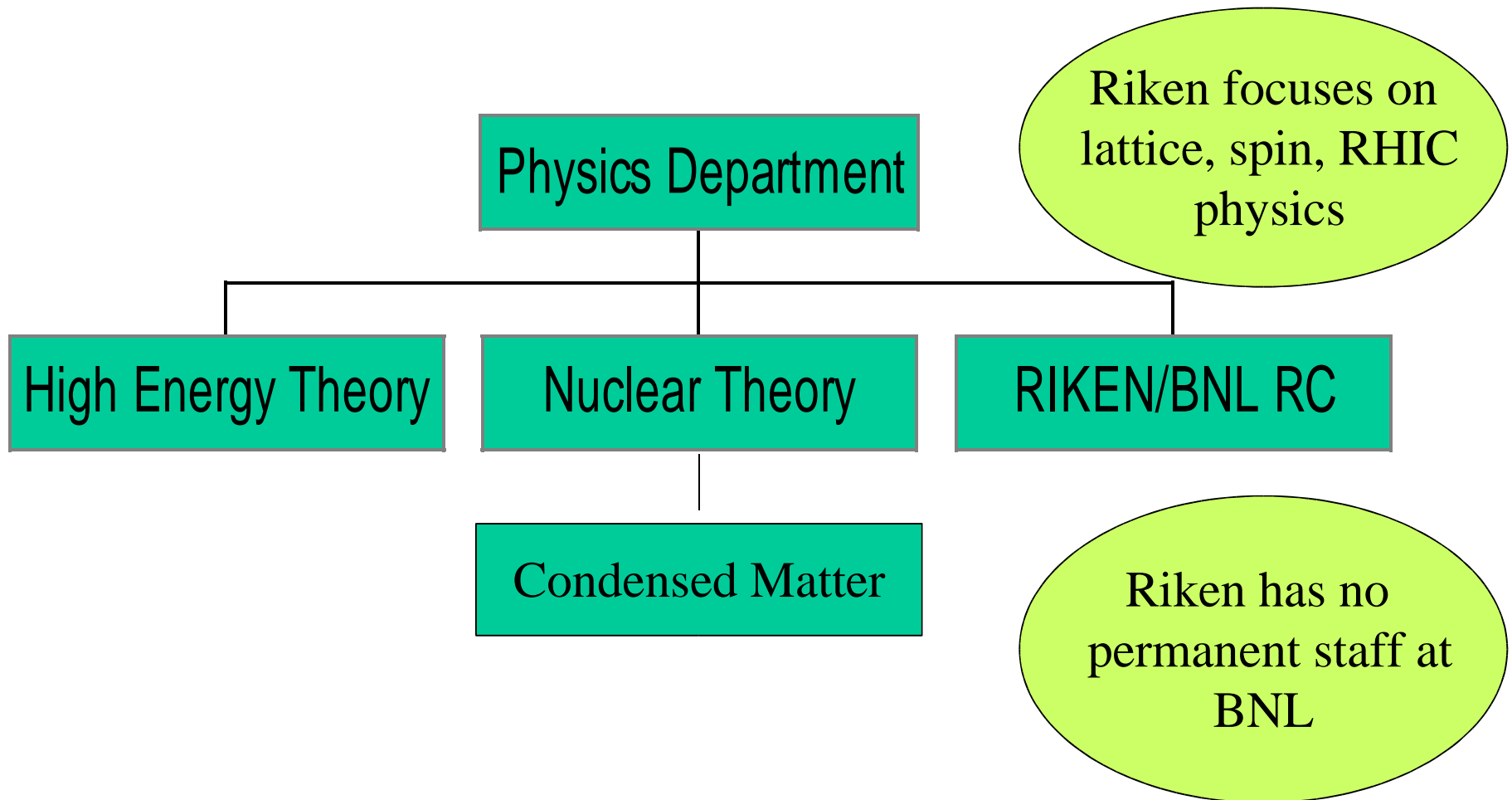
(Izubuchi paid by Japanese funds, left for permanent job at Kanazawa U.)

# *Group Activities*

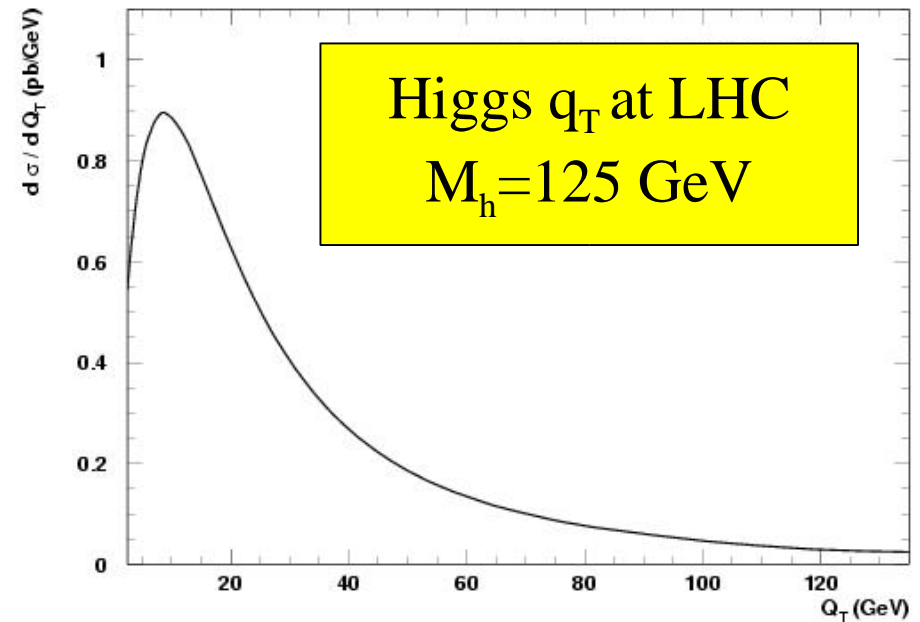
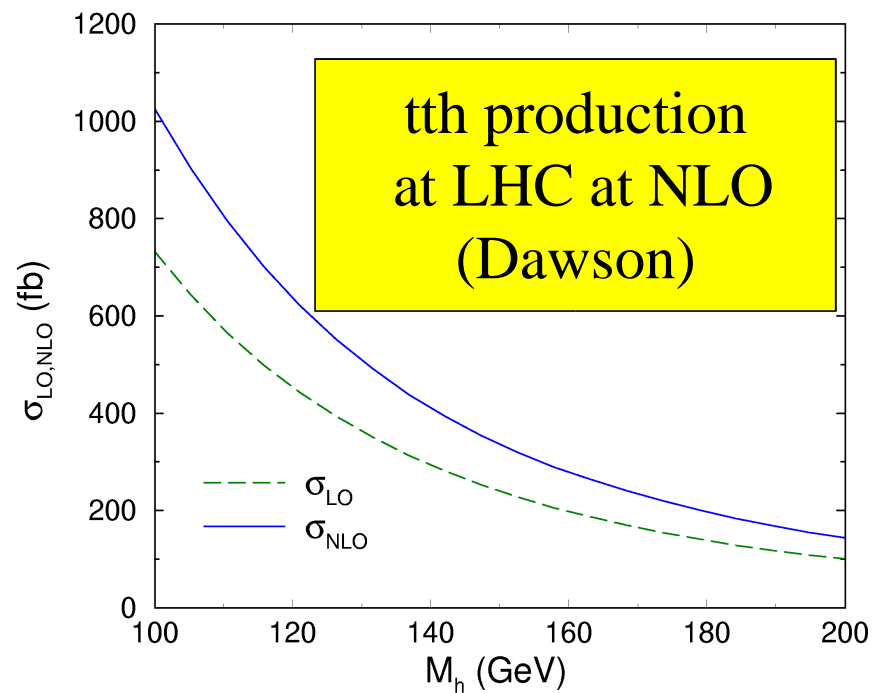
*Closely linked to US experimental program*

1. Collider physics
2. SUSY studies
3. Electroweak precision physics
4. QCD and Higgs physics
5. Lattice gauge theory
6. Field theory
7. Spin studies
8. Neutrino studies
9. B physics
10. Model Building

*Large Theoretical Effort  
in Physics department  
45 Theorists, (11 in HE)*



# *Higgs Physics and QCD (Dawson)*



Resummation of large  
logs in  $pp \rightarrow h$  (Kulesza)

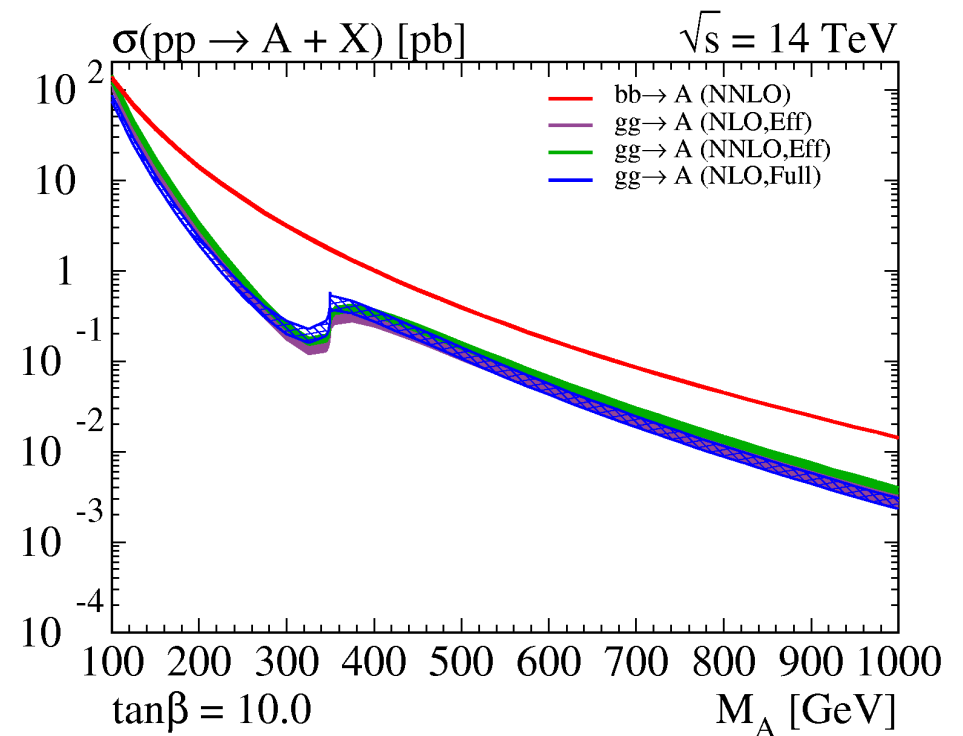
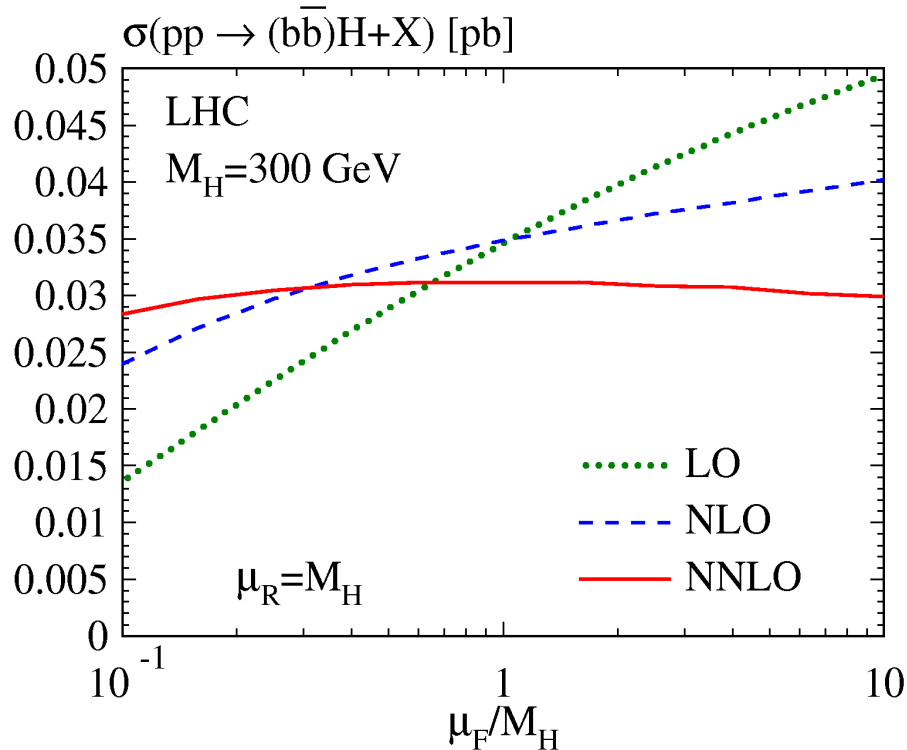
# Higgs Physics and QCD (Kilgore)

## $b\bar{b} \rightarrow H/A$ at NNLO

$b\bar{b} \rightarrow H/A$  can dominate at large  $\tan \beta$  because

$$\sigma_{bb} \sim m_b^2/M_H^2 \tan^2 \beta \quad \text{while}$$

$$\sigma_{gg} \sim A \cot^2 \beta + B m_b^2/M_H^2 + C m_b^4/M_H^4 \tan^2 \beta$$



# *SUSY at LHC (Paige)*

If SUSY is discovered, it will be important to have accurate calculations of masses and decays to compare results with models.

Several improvements in treatment of SUSY in ISAJET:

- **Include complete finite parts of 1-loop mass corrections.**  
[Pierce, et al., 1997]. (Logarithmic terms were always included by changing  $\beta$  functions at thresholds.)
- **Higgs vev's now included in RGE's.**  
(Effects are typically 1--5%. Now good agreement among calculations.)
- **Modified convergence and EWSB requirements to obtain better stability** (e.g., in "focus point" region where  $\mu^2 \rightarrow 0$ .)
- **Many small changes and bug fixes.**

# *Thermal Field Theory and RHIC*

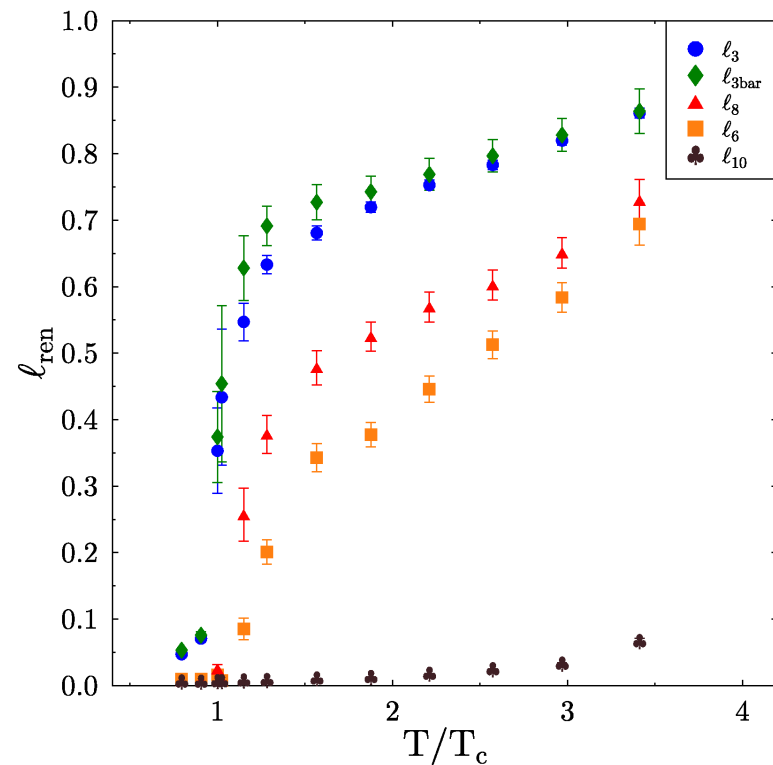
## *(Pisarski)*

### Renormalized Polykov Loops in SU(3) gauge theory

Extract values for different representations  
from bare lattice data as a function of  
temperature.

- Fundamental
- Sextet
- Adjoint
- Decuplet

Goal is to relate values to high  $p_T$  baryon  
excess at RHIC.





# *Public Service*

- Editorial work
  - PRD - Dawson, Pisarski, Paige
  - JHEP - Marciano
  - Computers in Science & Eng.
    - Creutz
- Lattice QCD SciDAC-EC
  - Creutz
- APS Service
  - APS Council, DPF chair-elect - Dawson
  - NYSS-EC - Kilgore
- DOE Service
  - P5, Facilities - Marciano
  - HEPAP Communications - Dawson

# Teaching

- Marciano, Adjunct at Yale, *Quantum Field Theory*, Spring, 2002
- Creutz, Adjunct at Stony Brook, *Lattice Gauge Theory*, Spring, 2001
- Dawson, Adjunct at Stony Brook, *Electroweak Symmetry Breaking*, Fall, 2001; *Particle Physics*, Fall, 2003.
- Graduate students:  
Kyoto (Pisarski), Princeton (Soni) & Stony Brook (Dawson)
- Summer Schools:  
PSI (Marciano), TASI (Dawson), Cargese (Pisarski)

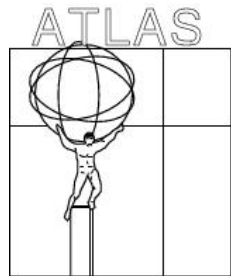
# *Planning for the future*

- Neutrino physics

- BNL working group  
(Chen, Marciano)
- Underground Laboratory  
Steering Committee  
(Marciano)

- ATLAS

- SUSY group leader  
(Paige)



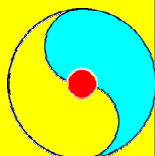
- Linear Collider Studies



- Working group leaders  
(Dawson, Marciano,  
Paige)
- LC Steering Committee  
(Dawson)

- B Physics working group  
(Soni)

# Large Scale Computations in Nuclear Physics Using the QCDOC



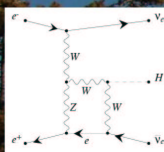
# Meetings organized by Theory Group Members

## Hadron Structure from Lattice QCD



### LoopFest II

Radiative Corrections for the Linear Collider: SUSY, QCD, New Physics



Brookhaven National

Laboratory

May 14 - 16, 2003

Organizers:

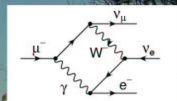
Ulrich Baur

Sally Dawson

Doreen Wackeroth

<http://quark.phy.bnl.gov/loopfest2>

email: [dow@ubpheno.physics.buffalo.edu](mailto:dow@ubpheno.physics.buffalo.edu)



**CIPANP 2003**

**Plenary Talks and Parallel Sessions Covering:**

- Light-Hadron and Hadron-Hadron Scattering
- Tests of Fundamental Symmetries
- Neutrinos
- Nuclear and Particle Astrophysics
- Light Quark and Lepton Physics
- Heavy Quark and Lepton Physics
- QCD Spectroscopy, Structure and Dynamics
- Jet Physics
- Accelerators, Heavy Ions
- Accelerators, Facilities and Detectors

**Intersections Organizing Committee:**

Dr. William J. Marciano, Chairman (BNL, NY, USA)  
 Dr. David Hare, Co-Chair (U. of Illinois, Urbana, USA)  
 Dr. Jeffrey A. Appel (BNL, IL, USA)  
 Dr. Edward L. Berger (BNL, IL, USA)  
 Dr. Ron Brinkmann (Cornell, IL, USA)  
 Dr. Thomas J. Bowles (BNL, NY, USA)  
 Dr. Stanley Brodsky (Stanford, CA, USA)  
 Dr. Mark Hutter (U. of Washington, USA)  
 Dr. Barry Roberts (U. of Massachusetts, USA)  
 Dr. Ron de Vries (BNL, NY, USA)  
 Dr. Toshiaki Ruan (Osaka U., Japan)  
 Dr. Frank Ruegg (Paris, Germany)  
 Dr. Gerson Segarra (U. of Buenos Aires, Argentina)  
 Dr. Zahid Patra (BNL, NY, USA)  
 Dr. Mark Stenlund (Brookhaven, IL, USA)  
 Dr. Alan Soper (TRIUMF, Canada)

**8th Conference on the Intersections of Particle and Nuclear Physics**  
 Grand Hyatt Hotel—NYC  
 May 19-24, 2003

For Additional Information see [www.cipnp2003.bnl.gov](http://www.cipnp2003.bnl.gov)  
 To communicate with Chair of the Local Organizing Committee  
 Dr. Zahid Patra, Physics Department 510A,  
 Brookhaven National Lab, Upton, NY, 11973-5000, USA,  
 send e-mail to: [cipnp2003@bnl.gov](mailto:cipnp2003@bnl.gov)

\*BNL = Brookhaven National Lab  
 IL = Argonne National Lab  
 NY = Stony Brook University Lab  
 CA = Thomas Jefferson National Accelerator Lab  
 OR = Los Alamos National Lab  
 UT = New York City

We encourage you to register at [www.cipnp2003.bnl.gov](http://www.cipnp2003.bnl.gov) as soon as possible. Please send an e-mail to [cipnp2003@bnl.gov](mailto:cipnp2003@bnl.gov) so that your address be included in the conference mailing list so that we can send you the conference updates.

**DPF 2003**

**April 4 - 8  
Philadelphia, PA**  
 in conjunction with  
 APS April Meeting 2003

**Special Session at PENN**  
**The Status of Particle Physics**  
 Monday, April 7  
 2:30-5:30 p.m.  
 University of Pennsylvania Museum  
 of Archaeology and Anthropology  
 Reception to follow

**Sponsors:**  
 Division of Particles, American Physical Society  
 Department of Energy  
 National Science Foundation

[www.dpf2003.org](http://www.dpf2003.org)